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HYDRAULIC PUMP

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2 Sheets-Sheet 1

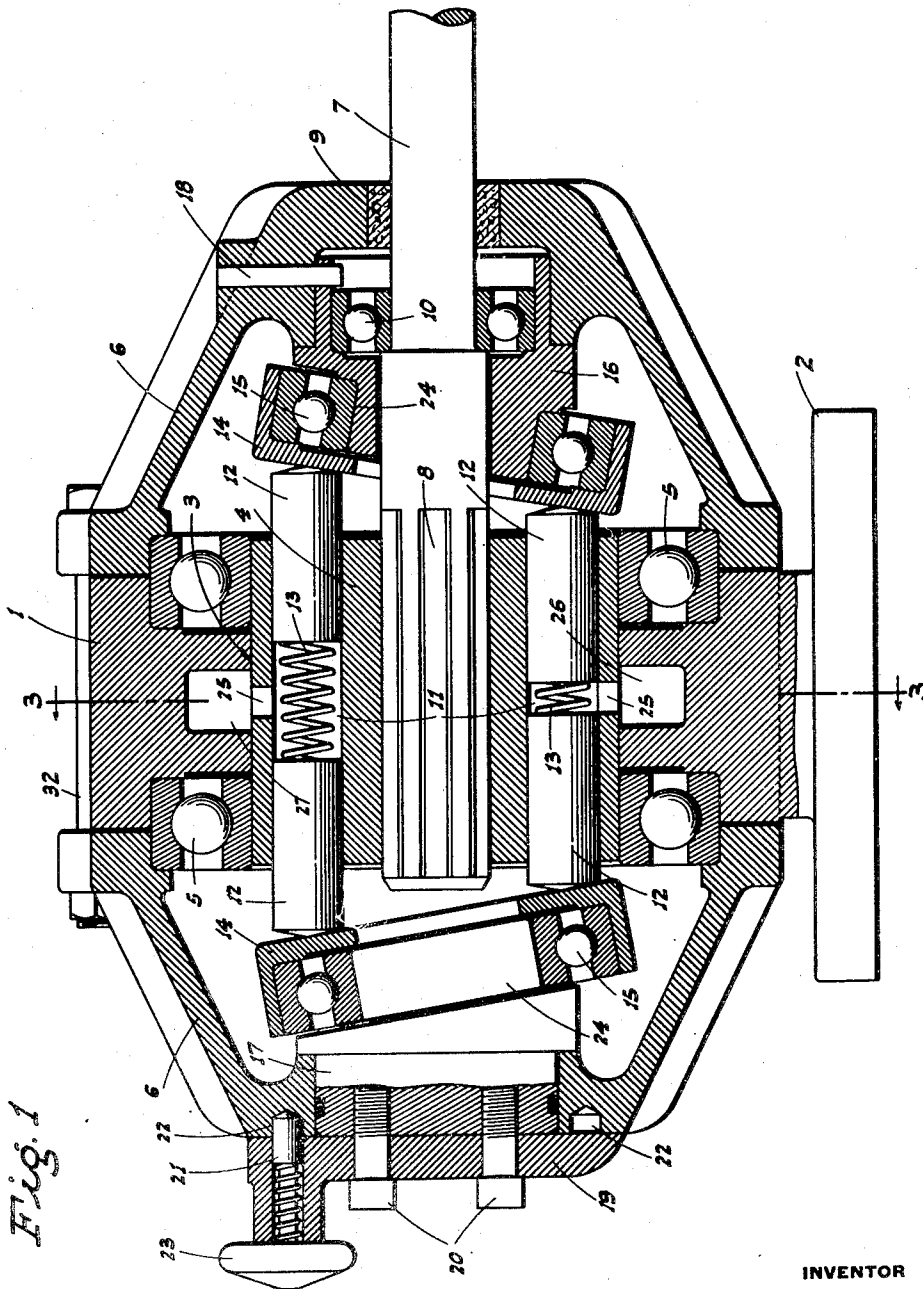


Fig. 1

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Fig. 2

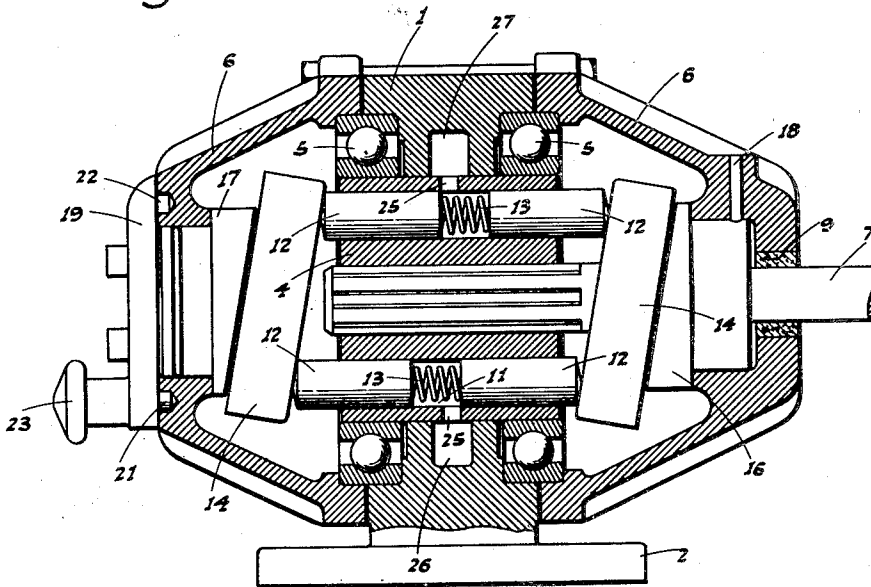
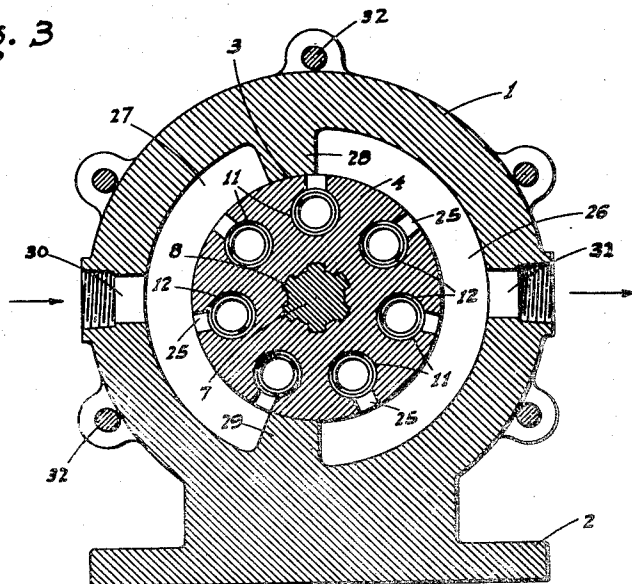


Fig. 3



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HYDRAULIC PUMP

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2 Claims. (Cl. 103-162)

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This invention relates to, and it is an object to provide, an improved constant displacement, hydraulic pump; the same being designed, but not limited, for use to supply hydraulic pressure for the operation of hydraulically controlled parts of earth working equipment, industrial mechanism, or the like.

Another object of the invention is to provide a novel hydraulic pump of rotary-piston type; there being novel mechanism embodied in the pump to convert rotary motion of the drive shaft to reciprocating motion of the pump assembly.

A further object of the invention is to provide, a hydraulic pump, as in the preceding paragraph, wherein said mechanism includes a novel thrust plate assembly arranged in cooperative actuating relation to cylinder-mounted pistons which project in aligned paired relation from opposite ends of a driven rotor in the pump; said thrust plates being adjacent opposite ends of said rotor and acting to normally cause opposed reciprocation of the pistons of each pair, and resultant pumping action, upon turning of the rotor.

An additional object of the invention is to provide a hydraulic pump, as above, wherein the thrust plates are relatively rotatably adjustable between a normally opposed but symmetrical acutely angled relation for pumping, and a parallel position to stop pumping, while permitting continued reciprocation of the pistons.

Other objects of the invention are to provide a hydraulic pump which includes a drive shaft capable of limited axial floating, as is desirable in certain installations; and a pump which only requires low pressure shaft seals.

It is also an object of the invention to provide a hydraulic pump which is designed for ease and economy of manufacture; the structure being simple but rugged, and the pump being efficient in operation.

A further object of the invention is to provide a practical and reliable hydraulic pump, and one which will be exceedingly effective for the purpose for which it is designed.

These objects are accomplished by means of such structure and relative arrangement of parts as will fully appear by a perusal of the following specification and claims.

In the drawings:

Fig. 1 is a sectional elevation of the pump, with the thrust plates in normal relative pumping positions.

Fig. 2 is a similar view, but shows the relative positions of the thrust plates for non-pumping operation, yet with the driven pump parts remaining in motion.

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Fig. 3 is a cross section on line 3-3 of Fig. 1.

Referring now more particularly to the characters of reference on the drawings, the improved hydraulic pump comprises a main body 1 which is generally circular exteriorly and relatively short axially; said body 1 being supported by a base or attachment flange 2.

Centrally thereof the main body 1 is formed with an axial, relatively large-diameter bore 3, and a rotor 4 is disposed in said bore with a close running fit. The rotor 4 is supported, adjacent opposite ends, by anti-friction bearings 5.

At opposite ends thereof the main body 1 is fitted with hollow end heads 6, and a drive shaft 7 extends centrally through one of said end heads and thence is splined, as at 8, into the rotor 4. The drive shaft 7 passes through a seal 9 in the corresponding end head 6, and said end head also includes a shaft-supporting bearing 10.

Radially out from the spline connection 8 of the shaft 7 with the rotor 4, the latter is formed with a circumferential concentric row of cylinders 11; such cylinders being parallel to the axis of the rotor and extending from end to end thereof.

A pair of pistons 12 are disposed in each cylinder 11 and project out of the opposite ends thereof; there being a heavy-duty helical compression spring 13 in each cylinder 11 between the adjacent inner ends of the corresponding pair of pistons 12. These springs are under load at all times and tend to separate the pistons 12 of each pair.

Beyond each end of the rotor 4, the pump includes a thrust plate 14, each rotatably carried by a bearing 15 on the inner end portion of a trunnion; the latter being indicated at 16 and 17.

The trunnion 16 is fixed in connection with the corresponding end head 6, being prevented from rotation by means including a securing pin 18.

The trunnion 17 extends in rotatable relation through the corresponding end head 6, and at its outer end said trunnion is fitted with an enlarged rotary adjustment disc 19 secured in place by cap screws 20. The rotatable trunnion 17 is adapted for 180° adjustment, and is releasably secured in adjusted positions by a spring pressed detent 21 adapted to seat in one of a pair of sockets 22 disposed 180° apart; the detent including an exposed hand knob 23.

The trunnions 16 and 17 have canted inner end portions 24 on which the thrust plates 14 are turnably mounted by the bearings 15, with said thrust plates facing inwardly and being engaged by the adjacent ends of the pistons 12. The portions 24 of the trunnions are canted in a manner such that the thrust plates 14 are in normally

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opposed but symmetrically acutely angled relation. In other words, the thrust plates 14 intersect the axis of the pump diagonally and in opposed but symmetrical relation.

Centrally of the ends thereof each cylinder 11 is formed with a radial port 25 which opens to the periphery of the rotor 4. In the radial plane of the ports 25, the main body 1 is formed with a pair of part-circle channels 26 and 27 which open to the bore 3 and extend circumferentially about said rotor; the channels 26 and 27 forming a low-pressure and a high-pressure chamber, respectively, and being separated, at adjacent ends, by relatively short lands 28 and 29. An intake port 30 leads into the low-pressure chamber 26, while an outlet port 31 leads from the high-pressure chamber 27. One convenience of the present design is that the intake port 30 and outlet port 31 can be disposed on the main body 1 at selective points along the corresponding chambers.

With rotation of the drive shaft 7 and rotor 4, the axially aligned pairs of pistons 12 bear at the ends on the thrust plates 14 and traverse an annular path. With the thrust plates 14 angled, as described, the pistons 12 of each pair progressively separate during the first 180° of the path of travel, and then progressively approach each other during the remaining 180° of said path of travel. This is the pumping cycle, and the chambers 26 and 27 are disposed so that the ports 25 register with the chamber 26 when the pistons 12 are progressively separating, while said ports 25 register with the chamber 27 while the pistons are progressively approaching each other. The resulting pumping action is positive and effective; hydraulic fluid being drawn into the cylinders 11 between the pistons 12 as they separate, and discharged from said cylinders as the pistons approach each other. The lands 28 and 29 are positioned to close the ports 25 in close timing relation with respect to the suction and pumping strokes, respectively, of the pairs of pistons.

When the pump is in operation the thrust plates 14 are in the relative positions shown in Fig. 1, with the rotary adjustment disc 19 and spring-pressed detent 21, as illustrated in said figure.

One advantage gained from the use of a pair of thrust plates 14 working in cooperation with the pairs of pistons 12 is that said thrust plates are disposed at a much lesser angle with respect to the central radial plane of the pump than would otherwise be necessary. The result is that side thrust on the pistons 12 is reduced to a point of no material consequence.

The described pump assembly is also advantageous for the reason that the necessary valve timing is obtained without resort to the more complicated systems of timing as found in conventional pumps.

An additional advantage of the described pump assembly is that the shaft seals may be of low pressure type, as the shaft is not subjected at any point to high pumping pressure.

When it is desired to stop the pumping action of the pump without stopping relative rotation of its parts, the spring pressed detent 21 is released and the adjustment disc 19 is rotated 180°; i. e. until said detent falls into the other socket 22. In this adjusted position, the thrust plate 14 on the trunnion 17 has been turned to a position so that both of said thrust plates are parallel, as in Fig. 2. In this position the pairs of pistons 12 shift back and forth with turning of the rotor 4,

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but there is no relative axial motion between said pistons, with the result that no pumping occurs, even though the shaft 7 continues to be driven. This is an advantageous feature in an installation where the pump may be direct-connected to a constant power source.

Also, the relative suction and discharge strokes of the pistons relative to chambers 26 and 27 may be easily reversed by merely unbolting head 6, turning the same 180° (which reverses the position of the adjacent plate 14) and rebolting the head 6 in place. The other plate 14 is of course also turned from its original position to correspond.

The described pump is practical, efficient, and reliable, and although its structure is simple with few wearing parts, the pump is adapted for the creation of relatively high hydraulic pressures.

From the foregoing description it will be readily seen that there has been produced such a device as substantially fulfills the objects of the invention, as set forth herein.

While this specification sets forth herein the present and preferred construction of the device, still in practice such deviations from such claim may be resorted to as do not form a departure from the spirit of the invention, as set forth herein.

Having thus described the invention, the following is claimed as new and useful, and upon which Letters Patent are desired:

1. A pump comprising a casing provided with a central bore, end heads on the casing, a shaft projecting through and journaled in one end head, the shaft projecting co-axially through the bore, a rotor splined on the inner end of the shaft and having a close running fit in the bore, said rotor being provided with a plurality of circumferentially spaced cylinders lying parallel to the longitudinal axis of the shaft, opposed pistons mounted in each cylinder and the outer ends of the pistons projecting beyond the outer ends of the cylinders, yieldable means between the pistons in each cylinder tending to push them outwardly, part-circle channels in the casing concentric with and opening into the bore, the rotor being provided with a port opening from each cylinder into the circumferential plane of the channels, the casing being provided with an inlet port opening into one channel and an outlet port leading from the other channel, a trunnion supported in each end head, each trunnion including an inner end portion canted at an acute angle relative to the longitudinal axis of the shaft, a thrust plate turnably mounted on each trunnion and the inner faces of the thrust plates engaging the projecting end of the pistons, one trunnion being normally held in fixed position in the end head through which the shaft projects and the shaft projecting therethrough, the other trunnion being mounted in the other end head for rotation about its longitudinal axis and with its outer end exposed through the end head, means on such outer end to effect rotation of said last named trunnion through an arc of 180 degrees, and means to releasably set such last named trunnion in non-rotative position relative to the end head.

2. A pump as in claim 1 in which said last named means includes a flange on the outer end of the last named trunnion bearing against the end head, the end head being provided with circumferentially spaced sockets in its outer face, a spring pressed detent disposed in the flange

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and engageable with the sockets, and manually operable means to withdraw the detent from the sockets.

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